APPENDIX D

RATING SYSTEMS

SCORE CALCULATIONS

and

COMPARSIONS

DRAFT

Rating Methods in Use in Washington State

Introduction

The WSDOT was one of the first agencies to develop and implement a PMS. They started developing a rating system and what they call a priority array in the 1960's. The Washington State Legislature initially mandated the development of this procedure. This initial rating system includes 4 distresses and a windshield method for collecting the data based on the predominant distress severity and % wheel path extents

At present there are four different rating systems in use in Washington State. All of which have been developed and/or condoned by the WSDOT and a fifth method (WSEXT/OCI) which was developed by the local Washington agencies through their NWPMS User's Group, which was reorganize into the current NWPMA organization. Also, there are two different WSDOT approved rating manuals and the original manual developed by the NWPMS group, which is the pavement distress description portion of this manual.

The following is a list of these different rating methods:

1. Original WSDOT Matrix Base Windshield Rating method (PCR_1)
2. WSDOT Matrix Method modified for Local Agencies (PCR_2)
3. WSDOT Pavement Structural Condition Index (PSC_1) – continuous extents

3b WSDOT Pavement Structural Condition Index (PSC_2) – discrete extent ranges

4. Streetwise Rating System (PCR_3)
5. WSDOT Local Agency Method Using PAVER/ASTM Curves (CDI or OCI)

<u>1. Original WSDOT Matrix Base Windshield Rating Method (PCR_1)</u>

This method uses four distress types, longitudinal cracking, alligator cracking, maintenance patching and transverse cracks. Its basic premise is that it is a structural index, meant only to monitor load related fatigue or alligator cracking. By definition longitudinal cracking is the beginning stage of alligator cracking (low level severity), the alligator cracking distress type is define as the intermediate or medium severity level and patching the advanced or high severity alligator cracking (it has gotten so bad as to require patching). The transverse cracks are included to help model the needs of eastern Washington pavements, which are subjected to frost heave and related distress problems. To use this index correctly, the data must be collected as indicated by the above descriptions. Defining patching as the advanced stage of fatigue cracking and assigning high deduct values to it was done in part to insure the continued deterioration (shape) of the performance curve model used by the WSDOT.

<u>2. WSDOT Matrix Method adapted for Local Agencies (PCR_2)</u>

In 1984 the WSDOT contracted with the University of Washington to develop a PMS for local agencies based on their current system. The above rating system (PCR_1) didn't meet the local agencies needs in several ways and thus was modified to correct these insufficiencies.

First other distress types were added and the deduct values modified in the deduct matrices. Also, the definitions for longitudinal cracking and patching were modified to better meet the local agency needs.

3. WSDOT Pavement Structural Condition Index (PSC)

In 1993 the WSDOT and the University of Washington published the documentation for a new method of computing the score index for the States distress rating method. This system used a series of equations which were fit to existing data and developed around the idea of reducing each distress to its equivalent level of alligator cracking, a method similar in concept to the pavement design procedure based on the concept of equivalent thickness. This approach has some validity in the context of the above description of how the WSDOT rates their pavements, in that all they are actually monitoring is alligator cracking. However, this method and this approach to computing the index does not apply to local agencies except possibly for urban arterial pavements in the larger counties. But even to this day none of the counties rate their roads in complete compliance with the WSDOT procedures, even though most use the PSC index. The current WSDOT raters' manual does not even conform to the rating procedures required by the PSC and its initial development. This makes this index invalid and its use questionable by these local agencies. This index is not used by any of the local city agencies in Washington State or is it used outside of this state.

The initial correlation work done by the DOT on these data with the PCR_1 data showed reasonable results, however, the DOT does not let their pavements go below a score of 50. This is not true for local agencies and the differences are reflected in the comparison shown later in this Appendix. This difference is quit severe for the higher extent of alligator cracking for all severity levels.

4. Streetwise System (PCR_3)

This method uses five distresses, alligator, longitudinal and transverse cracking, patching and raveling. That is, it adds raveling to the original WSDOT method. However, it differs in how the index value is computed. A series of index score based matrices are used and only two distresses are included; alligator cracking and the predominate one of the other distresses, if present. The purpose of this approach was to provide a simplified paper and pencil method for the smaller local agencies. From the comparisons shown later in this Appendix it is clear that no correlation work was done with any of the existing rating systems in developing the Streetwise matrix values.

5. WSDOT Method Using PAVER/ASTM Curves (WSEXT) or (OCI Index)

The original WSDOT matrix based system and the PSC if windshield data collection is used had a major shortcoming, in that they were based on quantifying the extent using ranges or groupings to help simplify its use for collecting data from a moving vehicle. This causes large variations from year to year in the results and made it extremely difficult to obtain consistent results from different raters. It also did not provide the data needed to manage maintenance operations. For this reason the local agencies decided to go to a detailed quantification of each distress extent by collecting and recording actual areas and lengths for each distress type and severity level. This method requires the use of continuous deduct curves in place of matrices. This method was developed from the PCR_2 procedures by the local agencies themselves and was adopted in the late 1980’s. It is currently used by most local agencies involved in PMS in Washington State and is the primary method provided for in this manual.

Unfortunately, the WSDOT has never formally adopt deduct matrices or curves for the procedures adopted by the local agency or by the research project which developed their PMS. Therefore, the individual agencies and software developers have adopted their own which has resulted in a large array of individual distress score index systems. Since most Cities have adopted the WSEXT or OCI index method used in this manual this has not been an extremely difficult problem for them. However, for the counties that wish to use distress data such as raveling, flushing and others, they have been forced to adopt two indices, the PSC which is required by CRAB/WSDOT and the OCI, which provides the better index for making PMS related MR&R decisions. This can cause extreme difficulty in trying to share or communicate this type of data between various departments and/or individuals within an agency and to controlling bodies such as the CRAB and the WSDOT.

A comparison of these indices is included in the follow text. It can be seen that in the case of the PSC (WSDOT equations) and the PCR_3 (Streetwise) there is an extreme difference in the deduct values assigned in many cases. For a single agency, using a single score, this may or may not make any difference as long as the accompanying MR&R decision process matches the rating system/method and desires of the user. However, make sure that your rating system can provide the trigger values and distress types you need to make the decisions required by your MR&R operations.

Some unique examples which relate go this topic include:

1. San Juan County, which has only rural chip seal roads. They previously used the PSC to manage their system. Sense most of their distress was flushing; they were not including their primary distress information in the score (PSC) values they were using to manage their pavements. Because CRIS included raveling and flushing on their data entry screen they assumed it was used in the calculation of the PSC and were unaware of the fact that it wasn't.
2. Arterial and Collector streets must be managed separately in most city agencies. Because of this a strictly structural based index may work for the arterial and collector arterial streets but would not be adequate for residential streets.
3. Most counties have separate urban and rural roadway networks, each of which requires different distress data to be manage properly. Only an index that includes structural and non-structural distress data can meet the combined needs of such a network.
4. Only a state route system that does not include local access or residential pavements can be run from a structural index only.

Further Discussion

The original WSDOT's windshield rating procedures only include four distress types, Longitudinal Cracking, Alligator/Fatigue Cracking, Maintenance Patching and Transverse Cracking. Longitudinal Cracking is defined as the initial stage of load related Alligator Cracking. Alligator cracking is defined as fully developed Alligator Cracking and Patching as the advanced stage of Alligator Cracking (the repair of). Therefore, only two distress types are being monitoring, Alligator cracking and Transverse Cracking. For this reason the WSPSC & $WSPCR_1$ rating procedure and resulting computed scores represents a pavement structural index and is currently being called the PSC (Pavement Structural Condition Index). WSDOT originally called this the PCR or "Pavement Condition Index". Full details of how this system is implemented are included in the following text.

This rating system is well suited for properly engineered pavements, which fail due to their designed repetitive truck loadings. However, it does not address or account for any other mechanism of pavement failure or provide an indicator of a pavements need of rehabilitation or maintenance due to distresses other then alligator cracking. This can be a limitation for local agencies and should be well understood when implementing this system. The WSEXT rating system is designed for and intended as a natural expansion of this system that provides full compatibility while providing for other needs, which are more indicative of local agency requirements. A comparable structural index can still be computed while allowing for other indices to be evaluated, such as environmentally (non-structural) related distresses.

The PCR and PSC systems were intended to be used for statewide comparison purposes and must be implement as outlined here. Therefore, a clear understanding of how these systems are used by WSDOT is important for local agencies to understand, especially for urban pavement systems. The four distresses used in computing the PSC and the way in which the data is collected must be included in any system used by local agencies. The patching distress is the single most import aspect of this system when trying to compare results with WSDOT. A key issue here is that most local agencies do not use the same maintenance practices as WSDOT. This is addressed in the WSEXT System by allowing for a separate maintenance patch type, which corresponds to the patching severity used by the WSPCR & WSPSC rating procedures. This system also separates the longitudinal cracking into two types, fatigue and reflective cracking. By collecting the data in this manner both the PSC and WSEXT indices can be computed from the same data set. A complete description of the original WSDOT system is available in the original WSDOT distress rater's manual and in part is included here.

Distress Rating Procedures
Both the PCR_1 & PSC rating procedures include four distress types, Longitudinal Cracking, Alligator/Fatigue Cracking, Patching and Transverse Cracking. Therefore, both the PSC and PCR_1 represent a structural index and do not reflect any pavement deterioration related to environmental or other non-structural defects in the pavement. In operating your PMS this becomes especially import in that no MR&R type decisions or related planning or budgeting can be performed aside from the overlaying or reconstruction of structurally failed roadways.

If the discrete finite range method of implementing the WSPSC approach is being used, both the WSPSC and WSPCR systems use identical rating procedures and extent ranges but have quite different score values. That is, the only difference is in how the resulting score is computed for each system. If actual % area and % length extent data are being collected, only the WSPSC system applies and defines a separate rating system from the use of the discrete extent ranges with the WSPSC procedures. Therefore, there is two ways in which the WSPSC rating procedures can be implemented. When using the discrete ranges of extent, a mid-point range value is assumed and used in place of the actual extent in solving the equations used in this system.

1. $WSPCR_1$ - Washington State Discrete Pavement Condition Rating System

This system is based on the pavement distresses and rating procedures outlined in the original raters manual provided by WSDOT and summarized in Appendix B and includes alligator, longitudinal and transverse cracking and patching. This system was developed with the goal of optimizing its use for collecting the data from a moving vehicle. All three severities associated with each distress are grouped together into the most predominate severity and the extents are defined using finite ranges of extent and percent wheel path to define the quantity. This allows the rater to quickly make decisions and to quantify the data as they drive done the roadway. The data being collected can be put directly onto a form or this system can be easily adapted to an automated type keyboard based system connected directly to a distance-measuring device (DMI).

The score, which is computed from this procedure, is based on a series of matrices and their associated deduct values. These deduct values, for a given segment of pavement, are summed together and subtracted from 100 to compute the resulting score or index value. WSDOT has traditionally called this index the Pavement Condition Rating or PCR_1. The following is a series of tables showing these deduct values. This score can go below zero and may be truncated or tapered below a given value within your PMS software to account for potential analysis problems. The PAVER/ASTM System defines a tapering or smoothing process, which is applied when multiple distress types or severities of a given distress occur within the same segment, which will automatically remove the possibility of negative indices. This is the preferred method even with the WSPCR procedure and may be available within your PMS software

Table 1 - Extent Ranges Used for each Distress Type

Extent Ranges	Alligator Cracking	Longitudinal Cracking	Transverse Cracking	Patching
1	0 - 9%	1% - 99%	1 - 4 Cracks	1% - 9%
2	10% - 24%	99% - 199%	5 - 9 Cracks	10% - 24%
3	25% - 49%	200% or more	10 or more	25% or more
4	50% or more	-	-	-

Table 2 - Asphalt and Bituminous Pavement Deduct Matrix

Extent	Alligator Cracks			Longitudinal Cracks			Transverse Cracks			Patching		
Range	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
1	20	35	50	5	15	30	5	10	15	20	25	30
2	25	40	55	15	30	45	10	15	20	25	30	35
3	30	45	60	30	45	60	15	20	25	30	40	50
4	35	50	65	-	-	-	-	-	-	-	-	-

Table 3 - Composite Pavement Deduct Matrix

Extent	Alligator Cracks			Longitudinal Cracks			Transverse Cracks			Patching		
Range	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
1	20	35	50	5	15	30	5	10	15	20	25	30
2	25	40	55	15	30	45	10	15	20	25	30	35
3	30	45	60	30	45	60	15	20	25	30	40	50
4	35	50	65	-	-	-	-	-	-	-	-	-

Table 4 - Portland Cement Concrete Pavement Deduct Matrix

Extent	Faulting			Cracking			Joint Spalling		
Range	Low	Med	High	Low	Med	High	Low	Med	High
1	5	10	15	5	10	15	5	10	15
2	10	20	30	10	20	30	10	20	35
3	20	30	40	20	35	50	15	30	50

2. CenterLine Windshield Distress Rating System

Introduction

The original $WSPCR_1$ windshield rating procedure was expanded for local agency use to include additional distress types. This rating procedure has been referred to as the "Local" deduct method in earlier Washington State PMS literature. The following tables show the deduct matrices currently used by the CenterLine software in this system. These raveling and flushing deducts are also used with the current detailed walking distress survey (WSEXT). Even though this procedure was developed for local agencies by WSDOT research funds, WSDOT did not establish or set standards for the use of this system.

Table 5 - Suggested Flexible Pavement Deducts – Taken from PAVER Deduct Curves

Extent	Alligator Cracks			Longitudinal Cracks			Transverse Cracks			Patching		
Range	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
1	24	38	52	11	22	45	11	22	45	5	22	37
2	39	56	69	16	31	62	16	31	62	20	41	68
3	44	59	74	29	44	86	29	44	86	50	58	80
4	56	74	87	-	-	-	-	-	-	-	-	-

Extent	Corrugation			Raveling/Flushing			Block Cracking			Crack Sealing		
Range	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
1	15	43	64	5	20	45	10	18	33	5	10	15
2	26	56	80	10	30	65	18	32	55	10	15	20
3	36	70	86	15	40	75	25	40	70	15	20	35

Extent	Rutting			Edge Raveling			Edge Patching			Lane < 10'		
Range	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
1	25	45	60	11	22	40	5	11	20	20	40	80

Table 6 - Suggested Portland Cement Concrete Pavement Deducts – from PAVER Curves

Extent	Raveling			Pumping			Faulting		
Range	Low	Med	High	Low	Med	High	Low	Med	High
1	6	18	35	10	20	35	5	15	30
2	10	25	48	20	35	45	20	30	50
3	15	30	60	35	45	55	30	50	75

Extent	Cracking			Joint Cracking			Patching		
Range	Low	Med	High	Low	Med	High	Low	Med	High
1	20	35	52	5	10	25	5	10	30
2	35	50	70	10	15	35	15	30	45
3	48	70	85	15	25	50	25	45	65

Extent	Wear			Blowups		
Range	Low	Med	High	Low	Med	High
3	10	20	30	35	70	90

3. Washington State Pavement Structural Condition PSC Equation Based System

This rating system uses the same distress types and descriptions as the $WSPCR_1$ system; however, it uses a series of equations to compute the resulting score, which is called the Pavement Structural Condition Index (PSC). This system can be used with the above discrete matrix based procedure by assigning fixed extent values for each extent range. The actual percentages associated with the extent for each distress type and severity can also be used with these equations. This actually defines two separate rating methods. The following is a section of computer code used to represent these equations. See the WSDOT publication WA-RD 274.1 for full details on how these equations were developed and documentation on this and the PCR procedures. The objective here is to give the user a quick outline of how the PSC is calculated

Alligator Cracking
```
EqAC = AL_HGH+(0.445*AL_MED**1.15)+(0.13*AL_LOW**1.35)þ
```
Patching
```
EqPT = PT_HGH+(0.445*(PT_MED * 0.75)**1.15)+(0.13*(PT_LOW * 0.75)**1.35)
```
Longitudinal Cracking
```
EqLC = (0.1*LC_HGH)+(0.445 *(LC_MED*0.1)**1.15)+(0.13*(LC_LOW*0.1)**1.35)
```
Transverse Cracking
```
EqTC = (0.6*TC_HGH)+(0.445 *(TC_MED*0.6)**1.15)+(0.13*(TC_LOW*0.6)**1.35)
EqC = EqAC + EqPT +qLC + EqTC
SegDed = 15.8 * EqC**0.5
IF SegDed > 100 THEN SegDed = 100
PCR = 100 - SegDed
SegDed = Segment Deduct value
*   - Symbol for multiplication
** - Symbol for raising a number to a power
```
Where: (All distress data are entered in % of Wheel Path/length, or count for transverse cracking, the mid-point of the extent range is used for $WSPCR_1$ method)

			WSPCR Mid-Point Extent
Alligator Cracking			
AL_HGH	=	gh severity	37.5%
AL_MED	=	dium Severity	12.5%
AL_LOW	=	Severity]	4.5%
Patching			
PT_HGH	=	gh severity	75%
PT_MED	=	dium Severity	12.5%
PT_LOW	=	w Severity	4.5%
Longitudinal Cracking			
LC_HGH	=	High severity	50%
LC_MED	=	Medium Severity	100%
LC_LOW	=	Low Severity	150%
Transverse Cracking			
TC_HIGH	=	High severity	2 Cracks
TC_MED	=-	Medium Severity	50
TC_LOW	=	Low Severity	150

4. StreetWise System

This system uses alligator cracking plus one of four possible secondary distresses to define its pavement score index. It uses a series of score based matrices to compute the score and quantifies the distresses in a similar manner as in the PCR_1 procedure. See the StreetWise Manual for full details.

5. A Detailed Discussion of the Walking Distress Rating System Used in this Manual – WSEXT/OCI

Introduction

To better meet the needs of local agencies and to make better use of automated rating procedures an extension to the original WSDOT WSPCR/WSPSC procedures has been developed and successfully implemented over the past several years. This rating procedure is referred to as the extended WSDOT rating system (WSEXT) and is a natural expansion of the original $WSPCR_{1\&2}$/PSC methods and provides the ability to measure the extent of the various distress types in greater detail and thus allow for the use of continuous deduct curves. It also provides access to several additional distress types not available in the WSPSC equations. This system uses the PAVER/ASTM system and associated deduct curves with minor changes. These include:

1. Transverse and longitudinal reflective cracking is rated as two separate distresses
2. A separate longitudinal fatigue crack distress type is included.
3. Utility patching is included as a separate distress
4. Crack seal inventory/rating is included
5. Raveling (weathering) and Flushing (bleeding) are rated using the predominate severity matrix method ($WSPCR_1$).
6. Rutting extent is assumed to be the full segment area and only the average depth is recorded.
7. Edge raveling has been expanded to include edge patching & edge lane width less than 10 feet.
8. Several of the PAVER distress types have not been included.

This system was developed over a 15-year period of application, starting in 1985, by local agencies within the northwest through joint research at the University of Washington, local agency user groups and the WSDOT. It reflects the needs and requirements of these agencies while still allowing for full compatibility with WSDOT's current rating operations. This system is currently being used by most of the larger Cities and Counties within the State and was developed out of an attempt by state and local agencies to establish a statewide standard uniform rating system.

Distress Rating Procedures

The detailed distress rating description and procedures associated with the WSEXT method are given in the main body of this manual. This system combines the WSPCR (WSDOT windshield rating system) and the PAVER/ASTM systems and makes the best use of each. It is designed to provide for the varying needs of both large and small local agencies and is adaptable to automated rating systems. The primary difference between the original WSPCR system and the WSEXT system is that several distress types have been added and the method of measuring the extent has been redefined to allow for detailed measurement of individual severities for each distress type. This also allows for the use of continuous deduct curves.

The distress quantification method used for raveling and flushing has not changed from the original $WSPCR_2$ procedures as originally defined for local agency use by WSDOT. The descriptions for Fatgue (Alligator) Cracking, Longitudinal Cracking and Patching have been modified to allow for local agency needs while still providing compatibility with the WSPSC system.

Distress Rating Computations

The PAVER/ASTM deduct curves are used with this procedure for computing the resulting score. The following table shows the PAVER/ASTM curves used by the WSEXT system. Other "Deduct Curves" could be developed. The ability to do this, along with proper guidelines should be included in your PMS software (or should be provided by WSDOT).

Table 7 - WSEXT - DEDUCT CURVE SUMMARY – Flexible Pavements

WSEXT		PAVER/ASTM	
#	**Distress Type**	**#**	**Curve Used**
1	Rutting *	15	Rutting
2	Fatigue Cracking	1	Alligator Cracking
3	Longitudinal-Fatigue Cracks *	1	Alligator Low for all severities
4	Longitudinal-Reflective Cracks	10	Transverse & Longitudinal
5	Transverse Cracking	10	Transverse & Longitudinal
6	Raveling	19	WSDOT Deduct matrix
7	Flushing	2	WSDOT Deduct matrix
8	Patching -Maintenance	11	Patch & Utility Cuts
9	Patching – Utility *	11	Patch & Utility Cuts
10	Corrugations & Waves	5	Corrugation
11	Sags & Humps	4	Bumps and Sags
12	Block Cracking	3	Block Cracking
13a	Edge Raveling	7	Edge Cracking Medium
13b	Edge Patching *	7	Edge Cracking Low
13c	Edge Lane < 10' *	7	Edge Cracking High
14	Crack Seal Condition *?	6	Inventory only
15	Ride Condition		N/A
16	Drainage Condition		N/A

* These distress types need new deduct curves developed for them

Table 8 - WSEXT - DEDUCT CURVE SUMMARY – Rigid Pavements

WSEXT		PAVER/ASTM	
#	**Distress Type**	**#**	**Curve Used**
1	Cracking *	24	Durability "D" Cracking
2	Joint & Crack Spalling	39	Spalling
3	Pumping & Blowing	33	Pumping
4	Faulting and Settlement	25	Faulting
5	Patching	29	Patching, Large & Utility Cuts
6	Raveling or Scaling	36	Scaling/Map Cracking/Crazing
7	Blowups	21	Blow-Up, bucking/Shattering
8	Wear		

Note: The PAVER system could be used for PCC in place of the WSDOT.

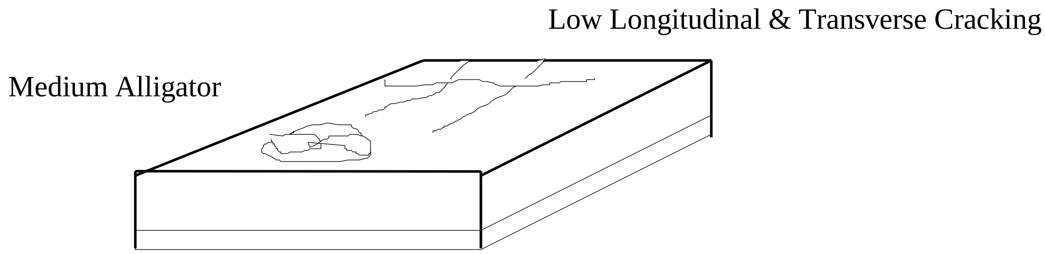
Summary and Recommendations

This system has been successfully implement by most of the Cities within the State, which currently have operating PMS systems and by four counties. This procedure tends to provide lower scores then the $WSPCR_{1\ or\ 2}$ due to the fact that there are more distress types included in the WSEXT method. This fact could be addressed by adjusting the deduct values in the $WSPCR_{1\ or\ 2}$ or by modifying the deduct curves in the WSEXT method. However the use of discrete extent ranges tends to decrease the scores, apparently do to the tendency to place marginal extent quantities into the next here range. Therefore, care should be taken when making the transition if an agency is currently using WSPCR ratings. This is also true for the WSPSC method. This will also affect your historical distress data and the resulting performance curves if you do switch from one system to the other.

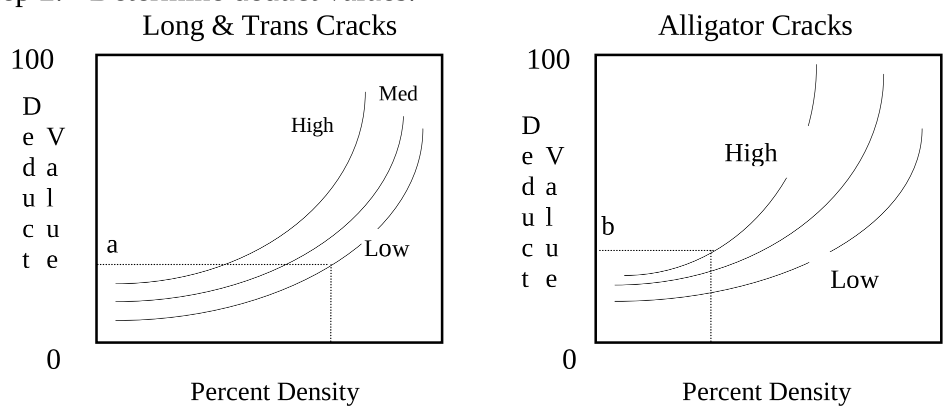
The greatest advantage of the WSEXT method is the increased accuracy and detail in the data. This helps to provide more consistent data from survey-to-survey and allows for the better management and modeling of routine and preventative maintenance and other repair operations.

The follow figures outline the steps involved in the PAVER/WSEXT rating procedures for calculating the final score. The actual deduct curves are included as a separate document in the CeneterLine help system. Access is also provided to the parameters that define these equations from within the program. This allows for modification of these curves by the individual user.

Step 1 - Inspect sample units: Determine distress types and severity levels and measure density.

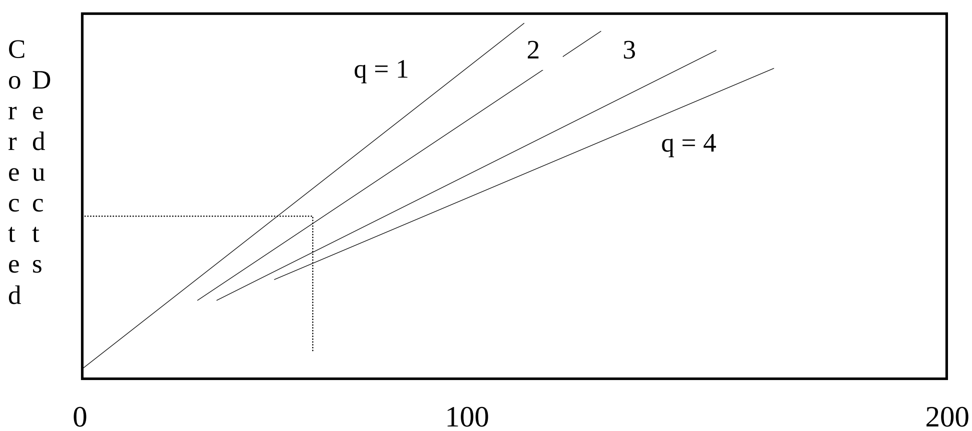


Step 2. - Determine deduct values.



Step 3. Compute total deduct value (TDV) = a+b

Step 4. Adjust total deduct value.



Step 5. Compute pavement condition index PCI/CDI = 100 - CDV for each for each inspected

Figure 1 – PAVER/WSEXT rating procedure diagram

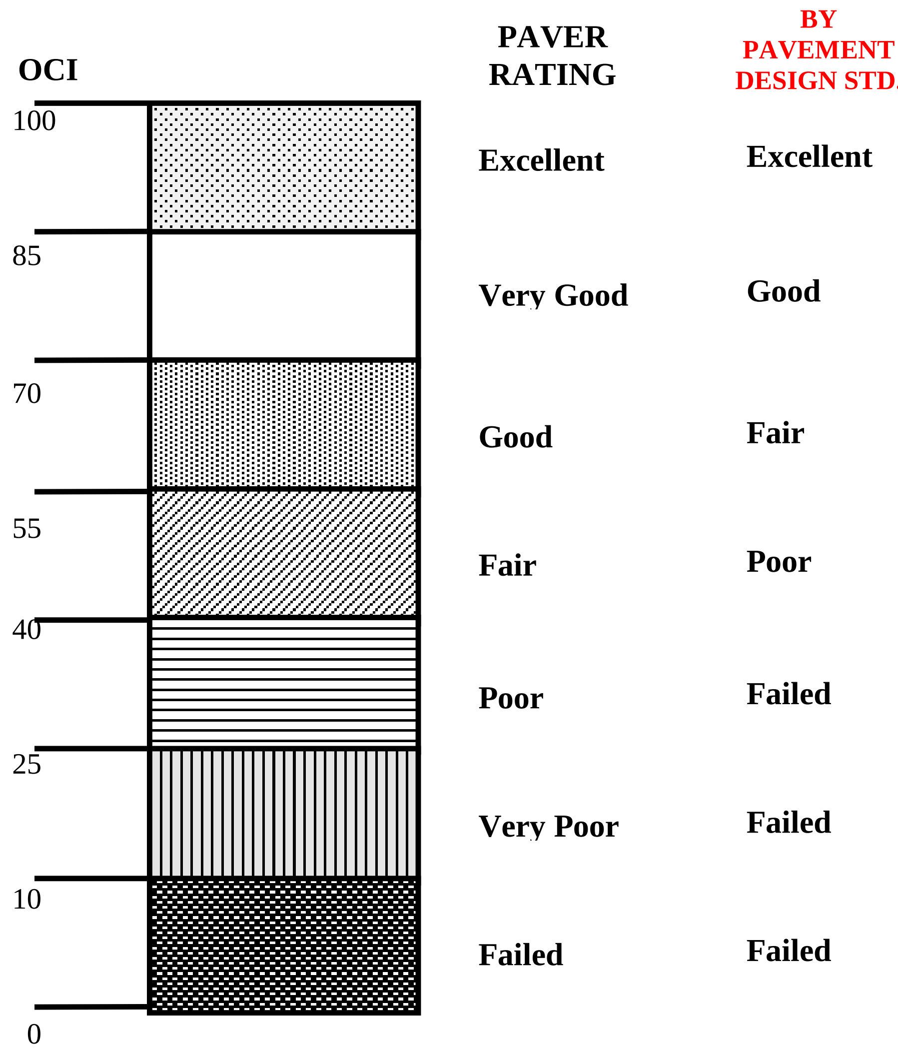


Figure 2 - OCI/PCI - Scale and Condition Rating

Comparison of PSC, $PCR_{1,2\&3}$, and WSEXT/CSI Rating Methods

The following tables are provided to help the user see some of the differences between the PSC, PCR_1, PCR_3 and the WSEXT Combined Structural Index (CSI) values computed using the PAVER/ASTM deduct curves. These data where extracted from the WSDOT publication WR-RD 274.1 (September 1993) and these values represent the deduct values assigned to each distress severity and extent combination as measured and assigned based on the field data collection operations. These numbers are subtracted from 100 to compute the score.

Table 9 - Alligator Cracking Deduct Values

Extent	Low Severity				Medium Severity				High Severity			
%WP	PSC	PCR_1	CSI	PCR_3	PSC	PCR_1	CSI	PCR_3	PSC	PCR_1	CSI	PCR_3
1	6	20	6	7	10	35	15	14	16	50	22	21
12.5	31	20	27	38	45	35	41	52	56	50	56	68
37	65	25	40	54	84	40	54	68	96	55	70	83
62	92	45	46	54	100	45	62	68	100	60	76	83
75	100	50	49	54	100	50	64	68	100	65	79	83

Table 10 - Patching Deduct Values

Extent	Low Severity				Medium Severity				High Severity			
%WP	PSC	PCR_1	CSI	PCR_3	PSC	PCR_1	CSI	PCR_3	PSC	PCR_1	CSI	PCR_3
1	5	20	2	0	9	25	10	5	14	30	19	12
5	14	20	10	21	23	25	22	38	31	30	37	62
25	41	25	25	33	57	30	45	58	68	35	72	80

Table 11 - Transverse Cracking Deduct Values

Extent	Low Severity				Medium Severity				High Severity			
%WP	PSC	PCR_1	CSI	PCR_3	PSC	PCR_1	CSI	PCR_3	PSC	PCR_1	CSI	PCR_3
1	5	5	2	0	9	10	9	0	14	15	18	0
5	15	10	11	4	21	10	20	10	32	20	44	20
10	23	15	17	9	23	15	22	17	23	15	17	36

Table 12 - Longitudinal Cracking Deduct Values

Extent	Low Severity				Medium Severity				High Severity			
%WP	PSC	PCR_1	CSI	PCR_3	PSC	PCR_1	CSI	PCR_3	PSC	PCR_1	CSI	PCR_3
1	1	5	0	0	3	15	0	0	5	30	4	11
100	27	15	15	n/a	40	30	28	n/a	50	45	56	n/a
200	43	30	22	n/a	59	45	38	n/a	71	60	76	n/a

Note: The PCR_3 index was added to the data in the original WSDOT report, which is provided in these tables

PSC = the index computed from the WSDOT equations
PCR_1 = Original WSDOT windshield discrete matrix method
CSI/PCI = WSEXT/PAVER/ASTM method
PCR_3 = Streetwise method

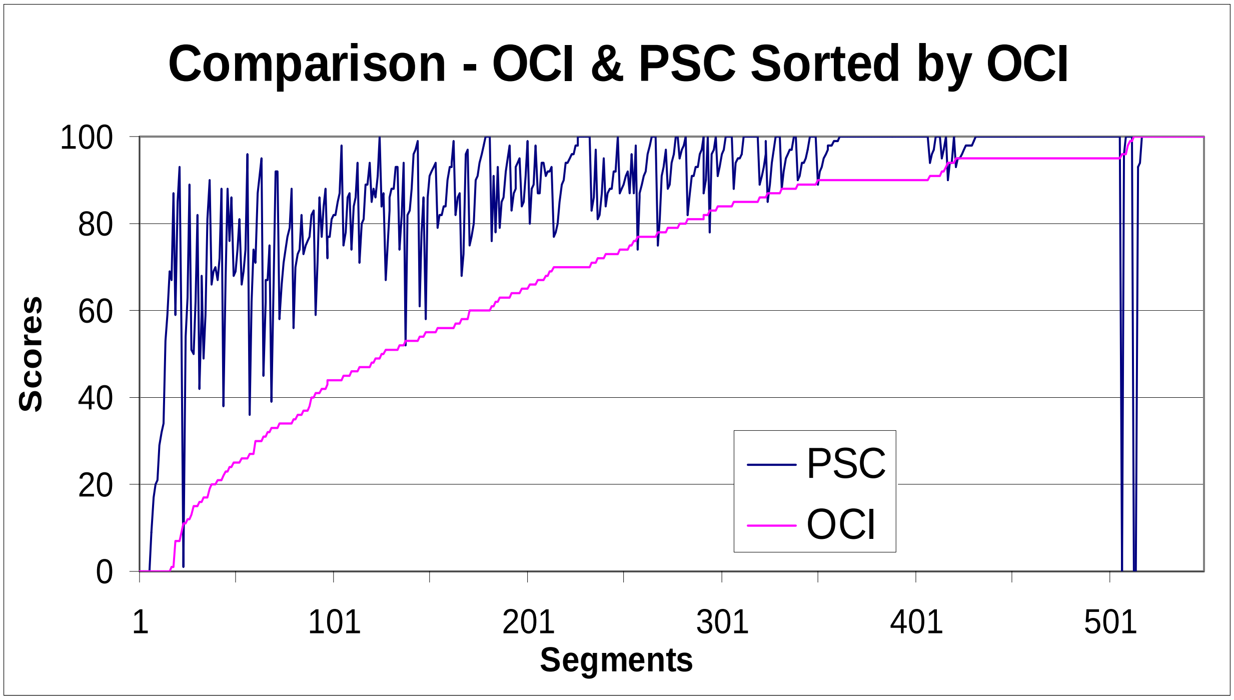


Figure 3 Comparison plot of OCI and PSC sorted by OCI

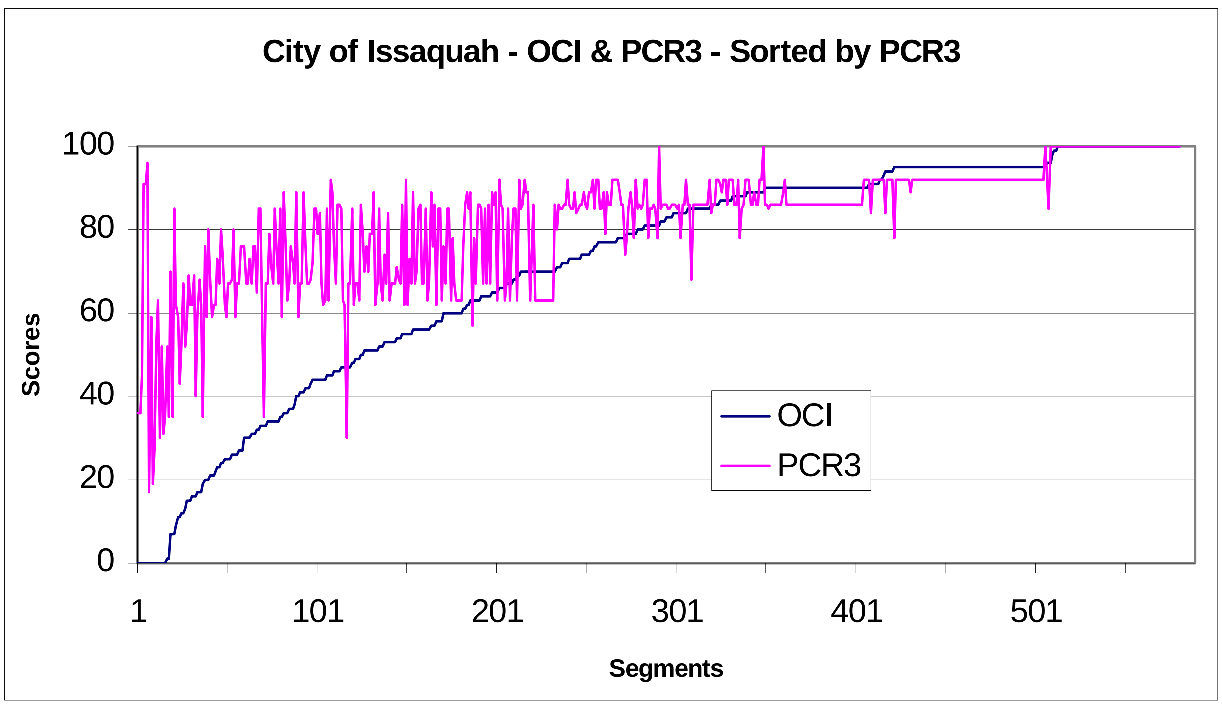


Figure 4 – Comparison plot of OCI and PCR3 sorted by OCI

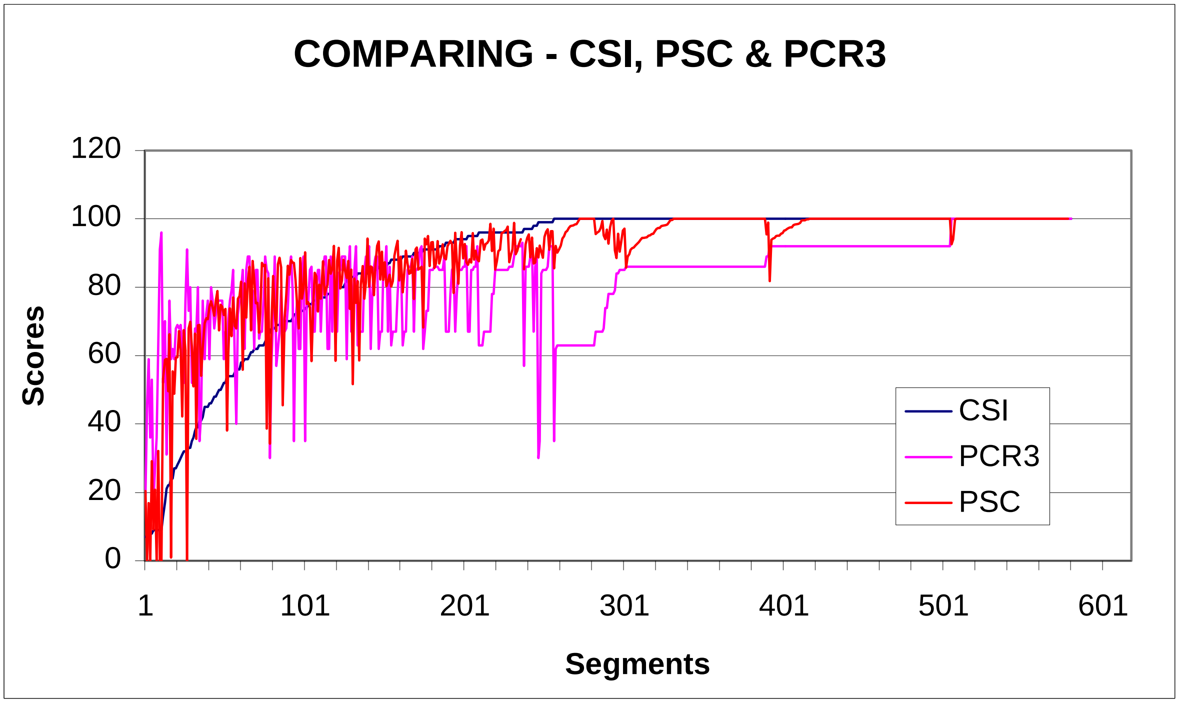


Figure 5 – Comparison plot of CSI, PSC and PCR_3 sorted by CSI

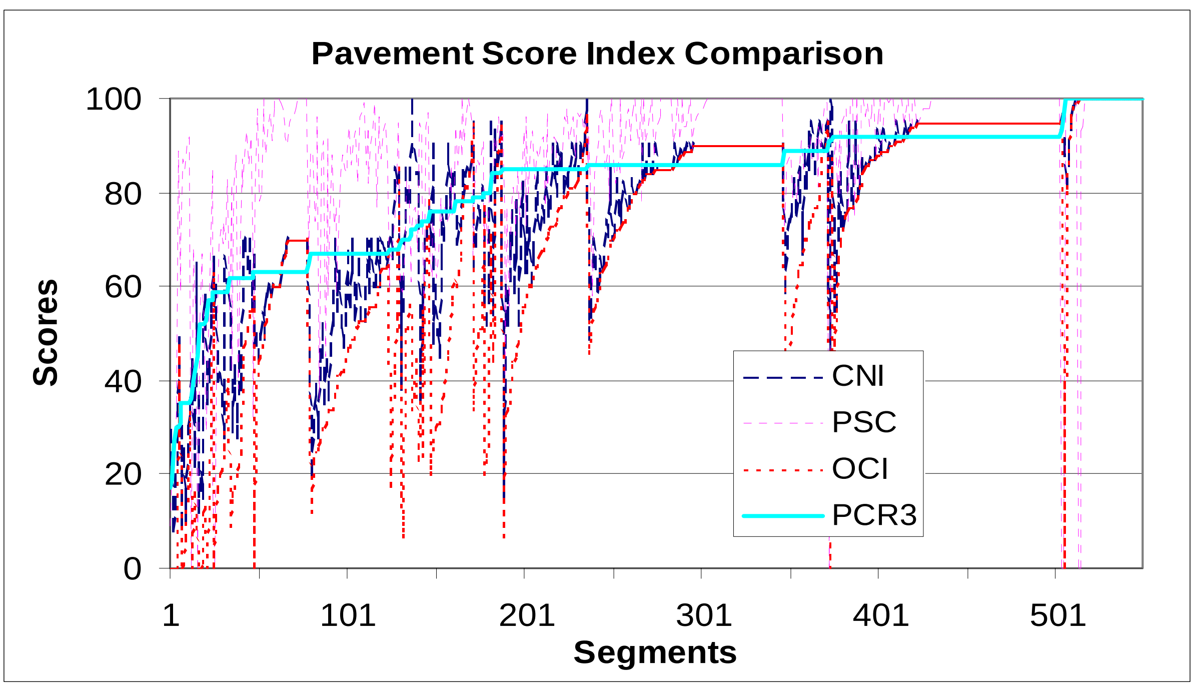


Figure 6 – Comparison of CSI, PSC, OCI and PCR3 sorted by PCR3 – (the CNI above should be CSI)

Table 13a – System wide index score averages

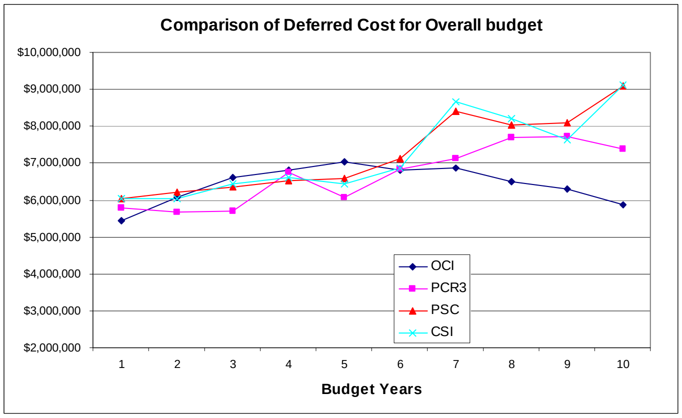
CLASS	OCI	CNI	CSI	PCR3	PSC
1	47	73	65	80	62
2	53	75	72	80	70
3	63	76	80	80	79
4	73	86	83	88	82
ALL	67	82	80	85	78

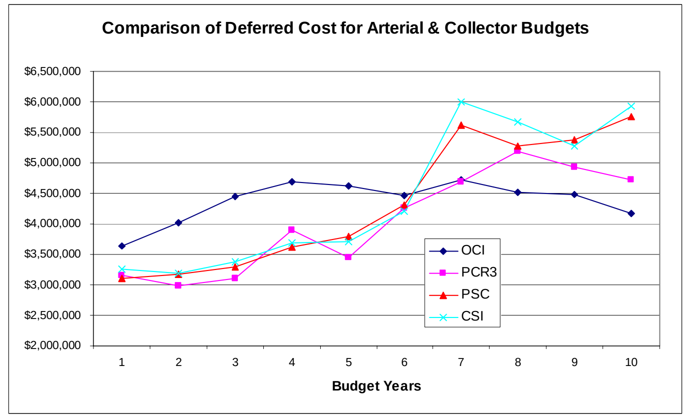
Table 13b – System wide index score averages normalized by the OCI

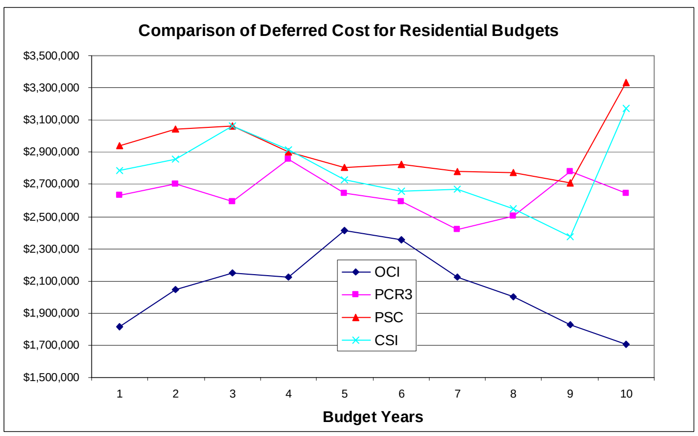
CLASS	OCI	CNI	CSI	PCR3	PSC
1	1	1.6	1.4	1.7	1.3
2	1	1.4	1.4	1.5	1.3
3	1	1.2	1.3	1.3	1.3
4	1	1.2	1.1	1.2	1.1
ALL	1	1.2	1.2	1.3	1.2

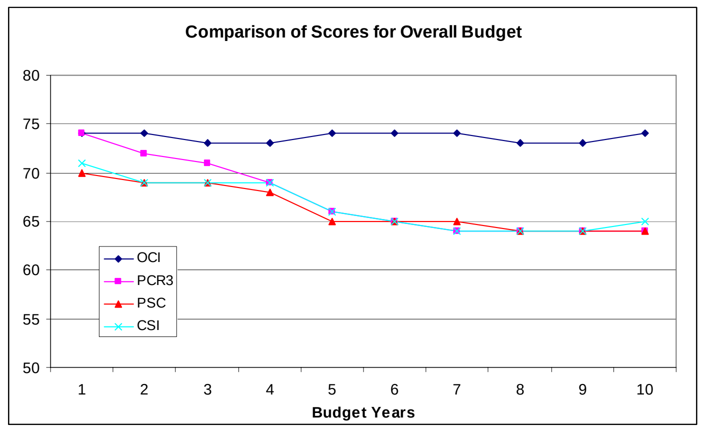
Table 14 – Index comparison based on 10-year network analysis

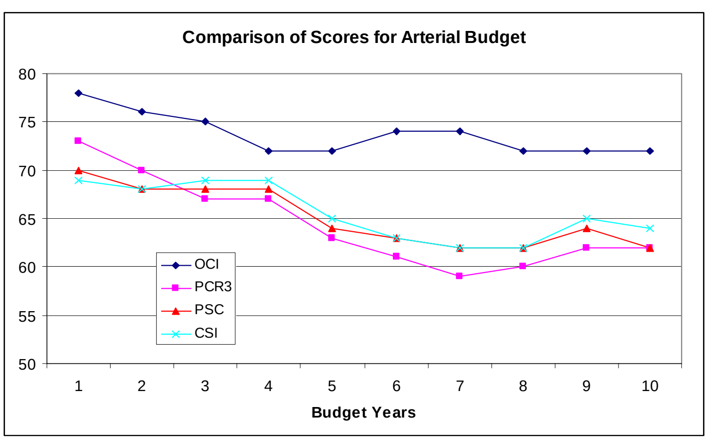
Index Used	Score Change		10 Year Deferred	Annual Added Cost
OCI	+6	68-74	$5,879,000	-
PCR3	-10	71-64	$7,368,000	$148,900
PSC	-10	67-64	$9,086,000	$320,700
CSI	-9	66-65	$9,108,000	$322,900











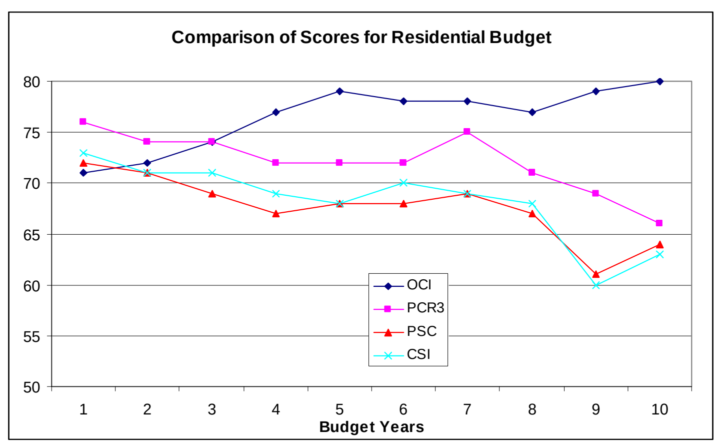
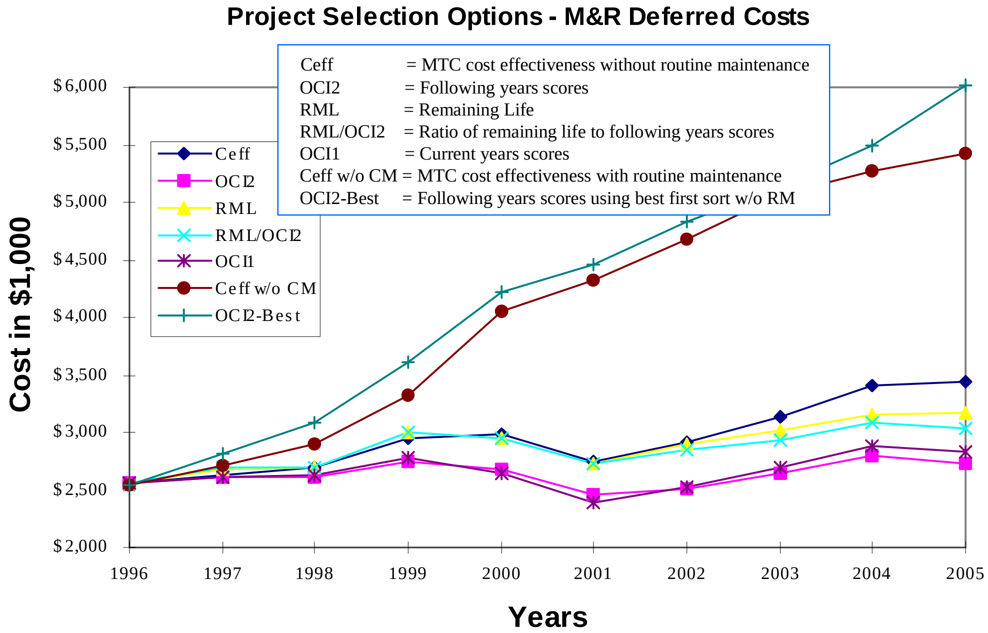


Figure 7 – Comparison of each index using PMS Network Analysis

Figure 8 – Deferred cost or back log for different index and sorting options – from Redmond, 1993



Evaluation of the Use of these Indices

The data used here is from the City of Issaquah, which has 49 centerline miles of streets and a population of 10,130.

There are two methods of evaluating the use of these different pavement distress indices, which will be presented here. The first is a simple heuristic discussion based on the above figures and the second will be based on performing a detailed optimized 10 year budget analysis using each of these indices separately, with an evaluation of the relative deferred costs (back log) produced by each and the system wide average scores. Any differences in the network analysis runs are caused by the MR&R repair lists developed by each separate index. Sense the primary objective associated with the use of any given index in PMS is to provide the data required to manage your roadway network; this is obviously the best approach to evaluating the value or performance of each of these indexes. The indices included here are the PCR_3, PSC, CSI and the OCI. Future work will include the PCR_1 and PCR_2. However, a comparison with these rating methods requires separate ratings of the same streets, over the same time period, using both walking and driving procedures or the simulation of the discrete data from the continuous data.

Default/Family curves were developed from each of these indices excepted for the CNI. All of these performed as expected. However, because of the higher score ranges associated with the PSC and PCR3, the default curves developed from these indices had higher expected lives than for the OCI/WSEXT method

The first method of evaluating these five indices is to discuss figures 3, 4, 5 & 6 above based solely on heuristic arguments. This approach has been taken over a more sophisticated statistical analysis for two reasons, first it is intuitive and easy to understand and second there was no simple statistical correlation found between the OCI index and the PCR3, PSC or the CSI. This lack of correlation is obvious from the plots given above. However, in Figure 4 it appears that there is some kind of intermittent correlation between the PCR3 and the other indices. This is most likely due to the discrete nature of selecting a secondary distress type when computing this index. Further analysis of this phenomenon is beyond the heuristic nature and objective of this analysis.

To begin with, it is intuitively obvious that if a given distress or condition resulting from a given distress is not included in the development of a given index (in the data collection phase and/or index computation) it is impossible to expect your PMS related operations to reflect this condition, whether you are doing a simple prioritization (sort) based on this index or a detail network analysis. For example, see the relative index values for the OCI, PSC & PCR3 in Table 15 below and the random scatter of the indices, which are not being sorted on in Figures 3, 4, 5 & 6.

This same argument can be extended to one of the limitations in the PCR3 method, in that if a given distress condition may or may not be included in the final score value, based on the fact that any one of four given distresses may be predominate at a given time, makes it impossible to reliably make decisions based on any distress condition other than possibly fatigue cracking. Even this is suspect in that it may or may not be influenced by the same second distress for any given distress evaluation. If you look at this index in the above plots you will see that it tends to have a more stare step type appearance then the others. This is do to the rather discreet type process of selecting a single second distress type based on the predominate secondary distress. This is typical of this type of procedure in any data collection operation. This is further exemplified in Figure 6, which appears to shows intermittent correlation over the data set.

Figure 5 shows a similar trend for the CSI, PSC and PCR3. This show that the PCR3 is more heavily influenced by fatigue cracking (structural distress) and exhibits characteristics closer to the structural indices, the PSC and CSI than to the overall combined index, the OCI/PAVER. This is further exemplified in Figures 1 & 2 where both the structural indices exhibit higher score values over the full data set (all segments) then that of the OCI.

A careful look at the index values presented in the small portion of the database shown in Table 15 shows the extreme variation in these numbers for each individual index and between segments. There is no way that these different indexes can provide comparable repair lists or network analysis results.

Tables 13 shows the variation in the average system wide index scores for each of the indices discussed here. First, this table makes it clear that the all indexes discussed here are 20 to 30% greater than the OCI index. This is caused by the fact that fewer distresses are included in the calculation of these indices and that the methods used to compute these scores produce these relative numbers. The relative average score values between these indices could obviously be adjust to better compare with each other by modifying the parameters associated with each. These numbers are based on 509 rated segments and were computed from the same data set simultaneously.

Evaluation of Each Index Using Network Analysis

In addition to the above discussion, the general independent random characteristics of the PSC, PCR3 & CSI when compared to the OCI and when compared to each other, implies that any project selection process based on any one of these indices would be independent of the others. Therefore, to evaluate the value (or characteristics) of each of these independent indices, a detailed network analysis was performed using each and the results are summarized in Table 14 and Figure 7. To allow for a reasonable comparison, the index scores for the CSI, PSC & PCR3 were scaled to give similar average system wide score values to that of the OCI. The numbers in Table 14 were used to perform the following evaluation and the plots in Figure 7.

As was shown in the CenterLine PMS Technical manual (figure 8), almost ten years back, any variation in the index used to optimize the network can affect the results substantially. Table 14 and Figure 7 are based on a ten-year analysis, using the same budget levels. These budget levels were establish by developing an opimal solution using the OCI index. Thus all other runs are being compared to this option. No other changes were made in the various runs, other than to scale the individual index values for each index to enable a direct comparison with the OCI analysis and decision strategies. Table 14 shows that the score drops by about 10 points for the non-OCI indices and that there is an average annual increase in the overall budgets of $148,900 for the PCR3, $320,000 for the PSC and $322,900 for the CSI based on the year 10 deferred cost totals. This is caused by the inability of these indices to properly select the correct streets for repair. This causes these streets to be pushed back in the decision process till the repairs for them are more expensive or they never do appear in the repair list, however, they still accumulate a larger and larger backlog or deferred cost.

The plots in Figure 7 further illustrate the characteristics of the four indices being evaluated. They also show the relative performance of each. Because of the inclusion of raveling the PCR3 shows better performance than that the PSC and CSI when looking at deferred costs, however, the score plots show it to be the worst at the end of the 10 year period with a continuing down word trend. However, the score trends tend to lag behind the trends in the deferred cost

It should be noted that most likely some of the projects, which are not being picked because of a given index would be in real life and the actual ten performance would most likely vary from what is predicted here. However, the fact that it exists at all substantiates the increased benefit of using the OCI index for network level planning. This would obviously mean that it is also better at ranking projects at the single or current year level as well.

Figure 8 further substantiates this argument. This analysis is include in the CenterLine PMS Technical Manual and was done on the City of Redmond's database in the early 1990's. It shows that when every you vary from a strait worst first ranking/sort based on the OCI your costs increase. This example actually shows a worst-case scenario when using the traditional cost effectiveness or cost benefit procedures.

CNI	CSI	OCI	PCR_3	PSC	LMY	ac1	ac2	ac3	lca1	lca1	lca3	lc1	lc2	lc3	tc1	tc2	tc3	mp1	mp2	mp3	rv1	rv2	rv3	egr	egp	upt1	upt2	upt3	ruts
59	7	0	67	0	1989	1105	532		70			14			16							3							
55	35	0	67	0	1995	6829						44			2							3							
60	33	0	67	0	1995	2468									3							3							
46	7	0	63	0		1917			63			180			18							3							
47	10	0	96	0	1997	126	8		61			199			21														
60	8	0	67	0	1995	3433			24									192				3							
98	6	0	96	0	1999	752	1		520			20			8			232	1120										
53	39	0	63	58	1981				192			112										3							
60	10	0	63	0	1981	152			370			12			2							3							
60	34	0	63	12	1981	8			500						1							3							
29	9	0	17	9		4750	100	26				89						548	40	480			2		240				
100	7	0	93	0		4740			250									432											
17	25	0	17	22		4000		2				85						1424	62				2		35				0.3
100	7	0	93	0		3960			365						2														
10	23	0	26	50		2054	20	18							15			210	50	12			3		20		50		
56	7	0	59	17		260	240	260											278	1100		3				120			
15	32	1	52	67	1999	200	1250	50	34			120	489		62	8		10	92	30		3		80	520	5613	120	20	
21	10	1	43	40		1096	2372		155	36.5		137		43.8	20	58			1169			2			20		36.5		0.5
98	9	2	85	0	1985	12			1806			30			96			338											
98	9	2	85	0	1985	12			1806			30			96			338											
52	23	3	52	62	1999	270	450	70	175			75			50			44		125		3		15	2	24			
93	10	4	100	0	1999	200			200			75																	
93	10	4	100	0	1999	200			200			75																	
44	9	4	59	48	1999	740	520	244	189	20		191	15	15	118	100		750		36		2				1524			
100	9	4	96	0	1997	760	108								5			250											
95	10	5	96	0	1999	128			85			54			9			434											
50	39	5	43	46	1997		1250			200					19			150				2				475			
99	10	5	96	0	1983	388			30			14			6			36											
91	11	6	96	0		120			185			123			3														
48	22	6	63	0	1989	200			25			102										3							
14	93	7	85	93		126	12	24							6			246			2								3

Table 15 – Sample database listing sort by OCI.

Final Discussion

All of the above indices are currently in use within the state and are referenced within this manual. For this reason the user of this data should have an awareness of how these indices differ. If the discrete steps used in the PCR_1 calculations are compensated for, the PCR_1 and WSEXT/CSI values agree with each other within acceptable limits, the same is true for the PCR_2 and the CDI. However, the PSC and PCR_3 scores are in worlds of their own, especially for alligator cracking in the case of the PSC, while the PCR_3 is all over the place. This is not necessarily of concern if an agency is using one index or the other, unless they are to change from one year's survey to the next. However, it could affect your MR&R decisions or the process used in making these decisions and obviously when comparing different indices between agencies.

Also, there is another area of concern which local agencies should be aware of. When considering how your agency's data will compare with other agencies within the state, extreme care should be taken of how you rate alligator cracking and patching and what index calculation procedure is being used. Alligator cracking dominates the PSC index and will be the key distress when comparing data between agencies; however, the potential for variation in how various agencies rate patching and how each performs their relative maintenance has even a greater potential effect. For example if an agency does a lot of relatively long skin or blade type patches or pre-leveling (can be considered an overlay at some point) and they classify these as patching and not a rehabilitation they benefit substantially when compared to an agency which does not do this type maintenance or which does not classify it in the same manor. This type of patch covers the full pavement area in question and would thus be assigned an extent of 100%, if considered a rehabilitation. This would result in a much higher deduct then if the underlying distresses were rated separately or the patch is rated as a patch and not considered an overlay.

Another more common example would be in how an agency quantifies or defines a given distress. If this varies from one agency to another, and the same index is calculated, it will not be the same.

Summary and Recommendations for PSC Calculations

This index is based on a concept of equivalent alligator cracking, which attempts to convert Longitudinal Cracking, Transverse Cracking and Patching to an equivalent amount of Alligator Cracking. There is no sound physical meaning to this concept other than that WSDOT actually defines Longitudinal Cracking and Patching as different severities of Alligator Cracking. However, if it is to be used for state-wide comparisons it becomes extremely important that your agency use the same MR&R practices and rating procedures as WSDOT if you are to try to compare your data to there's and other agencies. Unfortunately this is incompatible with the true concepts and benefits of a pavement management system and could force agencies into adopting MR&R practices, which are not optimal for their individual roadway networks and funding situations. Therefore, local agencies should not use this index.

Summary and Recommendations for PCR3/StreetWise Calculations

The primary reason given for the development of this index was to develop a paper and pencil procedure for rating the pavement and selecting MR&R actions for small agencies. Ironically, the PAVER/ASTM method was originally developed as a paper and pencil system and thus the WSEXT or CDI method can be done manually as well. (See the US Corp of Engineers, Technical Report M-294, Oct 1981). Also, the PCR_1 and PCR_2 can be used as a paper and pencil based method in a much easier manner than StreetWise, one page of deduct matrices and one step/line of calculations versus four pages of matrices and several calculation steps. However, there is one advantage when comparing the PCR_3 to the PRC_1 or PCR_2 methods. More detailed data is collected (even though it is not used) when using the StreetWise (PCR_3)

method and this data could be used to compute the PCI, CDI or PSC indexes at a later date. Also, the values produced by the PCR_3 index are so far removed from any other index currently in use, that care should be taken in comparing it to other indices, see tables at the beginning of this section. Also, if you are going to collect detailed data; use it, why go back to using a matrix method when you could just as easily use continuous deduct curves as in the PAVER/ASTM procedures? Also distress types other than the five used in this method are of value to the decision process, especially for maintenance operations. Also, only two distresses are reflected in the final PCR_3 score and the second distress can vary from one segment to the next and one survey to the next. This presents some concerns when prioritizing streets based in the PCR_3 in that streets with a different second distress type cannot be differentiated and the other distresses are not included at all. Also, what happens if there is no alligator (fatigue) cracking, but other distresses are present, are these segments being prioritized properly? Raveling is the more predominate or controlling distress in low volume roads and in these cases, raveling most often occurs without alligator cracking.

StreetWise is also referred to as a Pavement Management System (PMS). The term PMS is an extremely general term but to refer to the StreetWise procedures, as a PMS is somewhat of an overstatement, at a minimum a PMS has a database, budget planning and scenario comparison capabilities and the ability to analyze the impact of your decisions. Look at the AASHTO definition of a PMS in “AASHTO Guidelines for Pavement Management Systems, July 1990”. A better description might be a pavement management procedure, which follows or extends the natural process used by pavement rehabilitation and maintenance decision makers. That is, look at the street and decide what should be done to it and when it should be repaired based on existing funds. StreetWise is really just a rating system which suggests that the user sort or prioritize its results on this rating and assign a MR&R action based on five score ranges or groups defined by these scores. This is not a PMS by the AASHTO definition.

However, a full-blown PMS is not needed or does not necessarily even work for extremely small agencies and therefore, this procedure is adequate for its intended application if the PCR3 index contains the distress data needed to manage your roadways. Also, this procedure could be simplified further by adding the matrices and some equations to a simple MS Excel spreadsheet or a little code to an MS Access form or database. It’s hard to believe that even the smallest agency doesn’t have a PC. Also, if this is done, it’s just as easy to add the deduct curves as it is the matrices to the same spreadsheet. This would be less than a days work for someone skilled in the programming of a spreadsheet.

CenterLine Distress Index Definitions

To allow the CenterLine software to use the above indices and the various options associated with them in a single program and to allow for understandable documentation, three separate and new index definitions were developed. Further, within the software the individual distresses included within each are definable by the user. These new indices are:

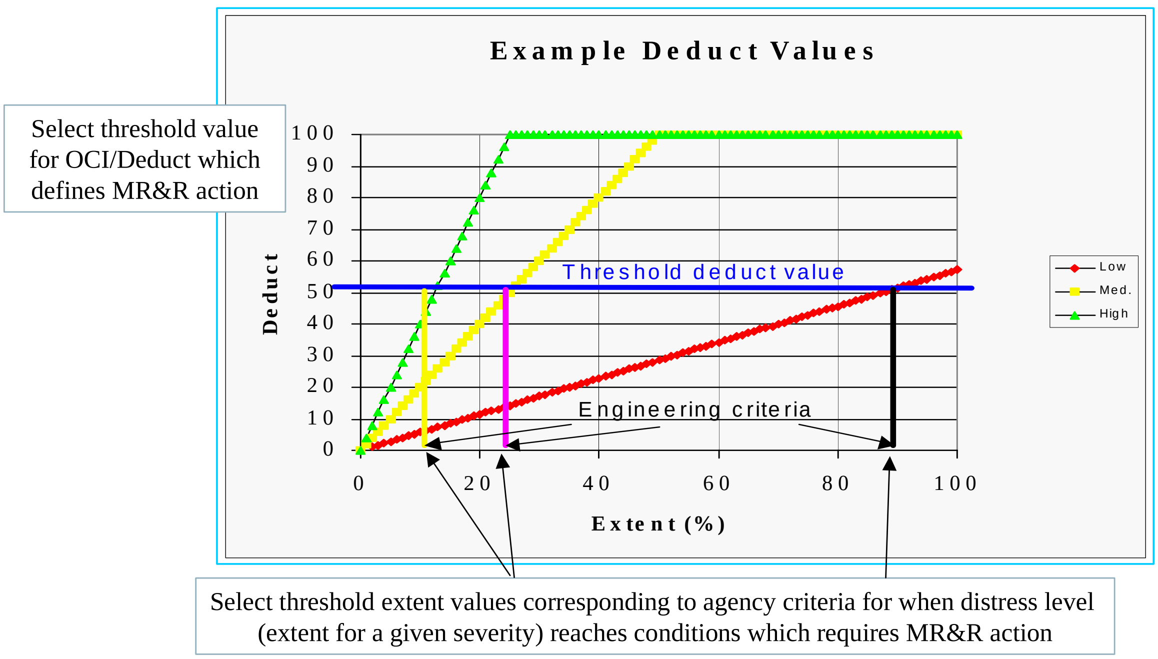
- **CDI** **Combined Distress Index** – this index is comparable to the PAVER/ASTM PCI and the WSDOT “Local Agency **PCR_2**” indexes depending on how your CenterLine rating system is setup. Within the CenterLine software the CDI is in general a combination of the CSI and CNI.
- **CSI** **Combined Structural Index** – this index can be computed and used in two different forms within the software. It can be set to use the **PSC** equations or it can be computed from the standard PAVER/ASTM deduct curves. This allows for full compatibility with WSDOT standards. The user can select the individual distresses used in computing this index when using the CSI.

- **CNI** **Combined Non-Structural Index** – This index is used to model the non-structural or environmental distresses such as raveling, reflective cracking etc. The CNI and CSI can be used in the PMS repair strategy process to make decision on MR&R actions.
- **OCI** **Overall Composite/Combined Index-** This index can be define separately for each pavement type and functional classification and can be a function of seven separate internal indexes, which includes the above three. Generally this index is set equal to the CDI.
- **PSC** **Pavement Structural Index** – This index is included in the CenterLine PMS and can be used in place of the CSI. It can also be used to define the OCI.
- **PCR3** **StreetWise Condition Index –** This index is also included in CenterLine PMS.

Recommendations for a Final Rating System

The WSEXT/PAVER method outlined in this manual is recommended as a starting point for the development of a statewide recommended or standardized rating system for Washington State Local Agency use. As discussed, this system was developed by the local agencies themselves and was agreed to by WSDOT in 1993. Further work needs to be done on developing deduct curves that better fit Washington Local Agency use. Procedures and recommendations for the development of these deduct curves and score calculations are presented here.

You may want to consider separate curves for City, County, small or large agencies and Urban and/or Rural networks or sub-networks. Procedures or options may also be needed to allow each agency to modify the system to meet their needs. These options would be difficult to manage and should be avoided if possible.



Note: This figure and this procedure were obtained from FHWA training course notes and other related literature.

The above figure outlines a process for developing deduct curves. The example uses straight line deduct curves, while log-linear or log-log base curves are most likely what should be used. But to start with lets define the procedure then discuss the options for implementing them. The idea here is, for each distress type, to define a threshold deduct value and an associated distress extent and to draw straight lines through these points with all lines beginning at or near the zero extent and zero deduct point.

A hypothetical example for fatigue cracking might be: Set the threshold at 50 deduct points, that is, at a deduct of 50 you want to define the need for rehabilitation. Also, for low severity you want to define this point to happen at an extent of 85%, for medium severity the extent will be 25% and high severity will be 10%. See the above figure for how this looks.

It can be shown that log-linear and log-log based deduct curves produce better default or family curves and thus a better index value. This is evident in the preceding discussion and from the literature. What is recommended here is to start with the PAVER curves and look at modifying these to better meet local use.

It is also recommended that an option be provided to allow for the use of a matrix approach for collecting data on raveling and flushing. This is based on two arguments. First, there is not much you can do but apply a seal coat, overlay or reconstruct a roadway to address this defect. Therefore, detailed area type measurements do not fit the desired rehabilitation and are not necessary. Also, raveling is an extremely difficult distress to observe and measure accurately and consistently. It is by far the hardest distress to train raters to quantify in a consistent and repeatable manner.

The following is a table, which could be used as is or modified to develop a starting point for the development of a final new system. The recommended score calculation procedures/algorithm should follow the ASTM manual for airport pavements.

#	**Flexible Distresses**	**Trigger Level ***	**Severity (% extent)***			**Low Limit**	**High Limit**	**Source**	**Comments**
			Low	**Med**	**High**				
1	Rutting/Waves	50		-	-			Wsdot?	Assume 100% extent – PCR_1
2	Alligator/Fatigue Cracking	50	40%	14%	4%	0.1	100	Paver #1	
3	Longitudinal Fatigue Crks #	30						Develop	
4	Longitudinal Reflective Crk	30	30	9.5	2.4	0.2	30	Paver #10	
5	Transverse Cracking	30	30	9.5	2.4	0.2	30	Paver #10	
6	Raveling	Wh path						wsdot	Use matrix approach - PCR_1
7	Flushing	Wh path						wsdot	Use matrix approach - PCR_1
8	Maintenance Patching	30	30	9	3	0.1	100	paver #11	
9	Utility Patching #	50						Develop	
10	Corrugation & Waves	30	40	4.5	0.6	0.1	100	Paver #5	
11	Sags & Humps	40	10	3	0.4	0.1	10	Paver #4	
12	Block Cracking	20	15	40	5	0.1	100	Paver #3	
13a	Edge Patching – Low Edge	50						Develop	
13b	Edge Raveling – Med Edge #	50						Develop	
13c	Edge Lane – High Edge #	50						Develop	
14	Crack Sealing #	50						N/A	
15	Ride Quality #	50						?	
16	Drainage #	50						?	

- * Values given here for trigger and % extent are taken from the PAVER curves
- # Do not have unique deduct curves – new curves needed

Note: Rigid or PCC pavements should stay as specified in Table 8 or the PAVER system could be used directly

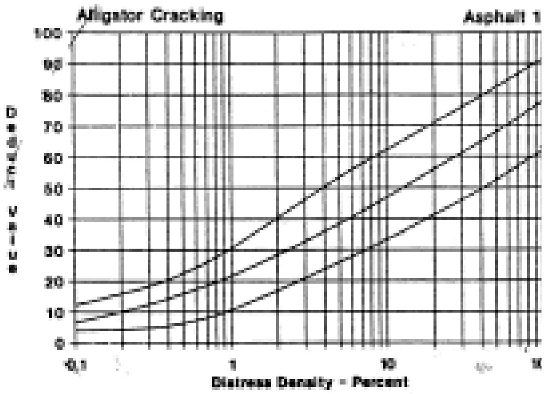


Figure B1. Alligator cracking.

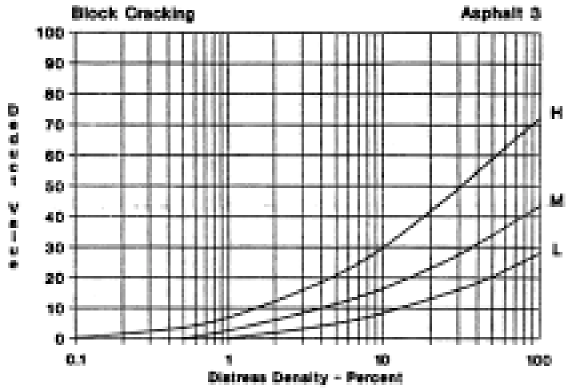


Figure B3. Block cracking.

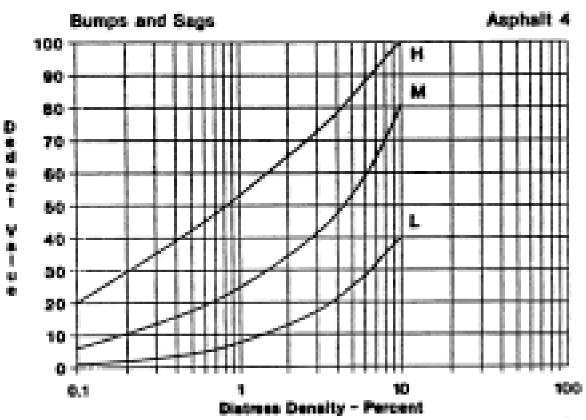


Figure B4. Bumps and sags.

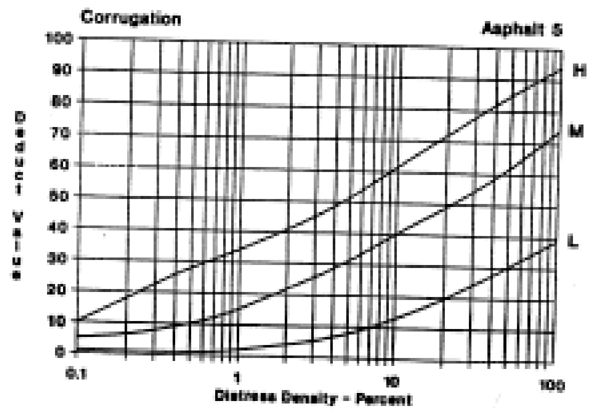


Figure B5. Corrugation.

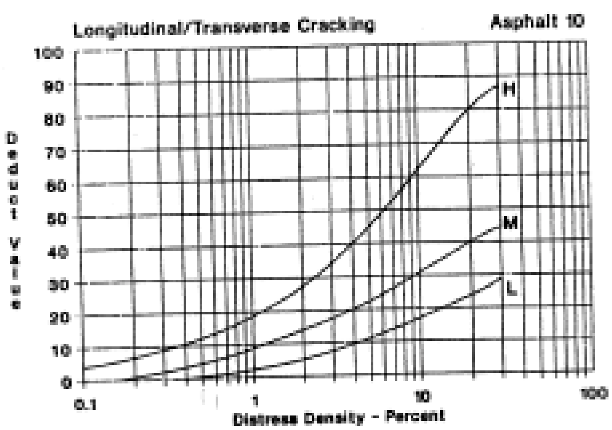


Figure B10a. Longitudinal and transverse cracking (English units).

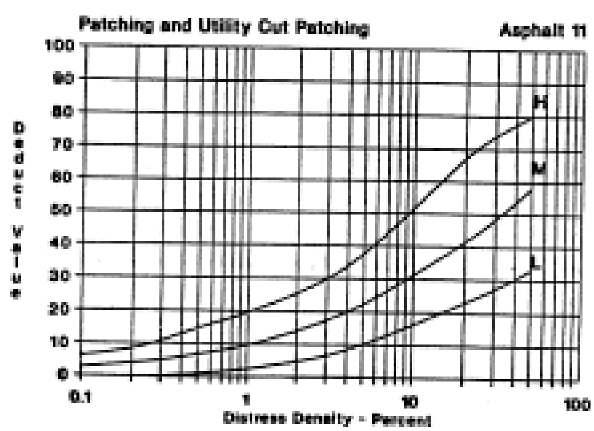


Figure B11. Patching and utility cut patching.

FLEXIBLE PAVEMENT INSPECTION FORM

Sq# ______

Date:

PAVEMENT/SEGMENT DATA

						Left	Right
Str/Sq#:			Sg Length:			Sidewalk Type:		
Str. Name:			Sg Width:			Sidewalk Width:		
From Desc:			Shldr/curb Type			Sidewalk Cond.		
To Desc:			Shldr. Width:			Sidewalk %Comp		
Bus Routes:		Speed	Min. Curb Ht.			Ramped Curb/Fr		
# Casting:		Lanes	StormSys.			Ramped Curb/To		
Pav. Type:		Class	Parking:			Striping:		
Observer:		Exempt	Bike Lanes:			Lighting:		

COMMENTS: (Including bridge, median, lane width and excessive crown information etc.) ______________________________

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DISTRESS TYPES		GRAPHIC
1. Rutting & Wear __________	9. Utility Patching (AR)	
2. Alligator/Fatigue Cracking (AR)	10. Corrugations & Wave ____________	
3. Long. Crack - Structural (LF)	11. Sags & Humps ____________	
4. Long. Crack - Reflective (LF)	12. Block Cracking ____________	
5. Transverse Crack (LF)	13a. Edge Raveling Ext. _____________	
6. Raveling __________	13b Edge Patching Ext. _____________	
7. Flushing __________	14. Crack Seal Condition ___________	
8. Maintenance Patching (AR)	15. Ride Quality ___________	

.	DISTRESS TYPES							
	2	3	4	5	8	9	13	
Direction								
Fwd								
Rev								
Total L								
Severity M								
Data H								
Previous L								
Rating M								
Data H								

RIGID PAVEMENT INSPECTION FORM Sq# ______

Date: PAVEMENT/SEGMENT DATA Left Right

Str/Sq#:			Sg Length:			Sidewalk Type:		
Str. Name:			Sg Width:			Sidewalk Width:		
From Desc:			Shldr/curb Type			Sidewalk Cond.		
To Desc:			Shldr. Width:			Sidewalk %Comp		
Bus Routes:		Speed	Min. Curb Ht.			Ramped Curb/Fr		
# Casting:		Lanes	StormSys.			Ramped Curb/To		
Pav. Type:		Class	Parking:			Striping:		
Observer:		Exempt	Bike Lanes:			Lighting:		

COMMENTS: (Including bridge, median, lane width and excessive crown information etc. here) ______________________________

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DISTRESS TYPES		GRAPHIC
1. Cracking # of panels	5. Patching # panels	
2. Joint/Crack Spalling # panels	6. Raveling or Scaling # panels	
3. Pumping & Blowing # panels	7. Blowups (enter # of Ocur)_____	
4. Faulting/Settlement # panels	8. Wear: (enter avg depth) ______	

	DISTRESS TYPES – Enter # of Panels						
Fwd	1. Cracking	2. Spalling	3. Pumping	4. Faulting	5. Patching	6. Raveling	# of panels in segment:
Rev	1/panel	1/8' - 1"	slight depr	1/8" - 1/4"	Good		
Low							
	(2 or 3)/pl	1" - 3"	mod dp,slst	1/4" - 1/2"	Fair		
Medium							
	> 3/pl	> 3"	sev. depr/st	> 1/2 "	Poor		
High							
Total L							
Severity M						____blowups	_____panels
Data H							
Previous L							
Rating M							
Data H							